

DESIGN APPRAISAL DOCUMENT

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. LR2064041TA-02

The undernoted documents have been appraised for compliance with the relevant International Conventions and UK legislation for the Type Approval of Marine Equipment for use on Merchant Ships Registered in the United Kingdom.

This Design Appraisal Document forms part of the Certificate that is issued under the authority given in the MCA Merchant Shipping Notice No MSN 1874.

MODEL AND TYPE DESIGNATION

BALPURE® BWMS – BP-6; BP-8; BP-12; BP-24; BP-36; BP-48; and BP-60

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Place of production 2: De Nora Elettrodi (Suzhou) Co., Ltd., No. 113, Longtan Road- Suzhou Industrial Park 215126, Suzhou City, Suzhou, Jiangsu Province, P.R. China

Equipment/Assembly Drawings and Documents

Type	Title	Dwg. No.	Rev.
Generic Drawing	Equipment Layout Flow Diagram BP6 (Distributed configuration)	BP6-F-50-M-USCG	1
Generic Drawing	Equipment Layout Flow Diagram - Filter BP6 (Distributed and Hybrid configurations)	BP6-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP6 (Distributed configuration)	BP6-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP6 (Distributed configuration)	BP6-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP6 (Distributed configuration)	BP6-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP6 (Distributed configuration)	BP6-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP8 (Distributed configuration)	BP8-F-50-M-USCG	1
Generic Drawing	Equipment Layout Flow Diagram - Filter BP8 (Distributed and Hybrid configurations)	BP8-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP8 (Distributed configuration)	BP8-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP8 (Distributed configuration)	BP8-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP8 (Distributed configuration)	BP8-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP8 (Distributed configuration)	BP8-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP12 (Distributed configuration)	BP12-F-50-M-USCG	1

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Generic Drawing	Equipment Layout Flow Diagram - Filter BP12 (Distributed and Hybrid configurations)	BP12-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP12 (Distributed configuration)	BP12-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP12 (Distributed configuration)	BP12-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP12 (Distributed configuration)	BP12-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP12 (Distributed configuration)	BP12-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP24 (Distributed configuration)	BP24-F-50-M-USCG	1
Generic Drawing	Equipment Layout Flow Diagram - Filter BP24 (Distributed and Hybrid configurations)	BP24-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP24 (Distributed configuration)	BP24-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP24 (Distributed configuration)	BP24-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP24 (Distributed configuration)	BP24-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP24 (Distributed configuration)	BP24-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP36 (Distributed configuration)	BP36-F-50-M-USCG	1
Generic Drawing	Equipment Layout Flow Diagram - Filter BP36 (Distributed and Hybrid configurations)	BP36-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP36	BP36-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP36 (Distributed configuration)	BP36-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP36 (Distributed configuration)	BP36-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP36 (Distributed configuration)	BP36-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP48 (Distributed configuration)	BP48-F-50-M-USCG	1
Generic Drawing	Equipment Layout flow Diagram - Filter BP48 (Distributed and Hybrid configuration)	BP48-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP48 (Distributed configuration)	BP48-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP48 (Distributed configuration)	BP48-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP48 (Distributed configuration)	BP48-P-03-M-USCG	0

Generic Drawing	General Arrangement - Power Supply Skid BP48 (Distributed configuration)	BP48-P-10-M-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP60 (Distributed configuration)	BP60-F-50-M-USCG	1
Generic Drawing	Equipment Layout Flow Diagram - Filter BP60 (Distributed and Hybrid configurations)	BP60-F-50-FILTER-USCG	1
Generic Drawing	General Arrangement – Electrolyzer Skid BP60 (Distributed configuration)	BP60-P-01-M-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP60 (Distributed configuration)	BP60-P-02-M-USCG	0
Generic Drawing	General Arrangement – Blower, Degas Separator, and Vent Stack Skid BP60 (Distributed configuration)	BP60-P-03-M-USCG	0
Generic Drawing	General Arrangement - Power Supply Skid BP60 (Distributed configuration)	BP60-P-10-M-USCG	0
Generic Drawing	Electrical Single Line Diagram (Distributed configuration)	BP-ESL-Z1-USCG	1
Generic Drawing	Electrical Interconnect (On Skid) (Distributed configuration)	BP-E-01-USCG	2
Generic Drawing	Electrical Interconnect (Skid to Skid) (Distributed configuration)	BP-E-50-Z1-USCG	2
Generic Drawing	Control Architecture (Distributed configuration)	BP-E-75-ARCH-Z1-USCG	0
Generic Drawing	Interconnect - Network Communication (Distributed configuration)	BP-E-75-Z1-USCG	0
Generic Drawing	Electrical Panel - Electrolyzer Skid (Main Control Panel Layout Diagram) (Distributed configuration)	BP-EP-01C-Z1-USCG	1
Generic Drawing	Electrical Panel - Booster Pump Skid (1 Booster Pump) (Distributed configuration)	BP-EP-02-USCG	1
Generic Drawing	Electrical Panel -Blower / Vent Stack Skid (2 Blowers) (Distributed configuration)	BP-EP-03-USCG	1
Generic Drawing	Electrical Panel - Analyzer / Neutralization Skid (Distributed configuration)	BP-EP-04-USCG	1
Generic Drawing	Electrical Panel - Cargo Control Room Remote (Distributed configuration)	BP-EP-50-Z1-USCG	1
Generic Drawing	Electrical Panel – Filter FWD- Forward, AFT- Aft Peak Tank, PORT- Port, STBD- Starboard (FWD may be substituted with PORT or STBD dependent on vessel configuration) (Distributed configuration)	BP-EP-21-FWD-Z1-USCG	1
Generic Drawing	Junction Box - Neutralization (Distributed configuration)	BP-EP-04-JB-USCG	0
Generic Drawing	Junction Box - Main Control Panel (Distributed and Hybrid configurations)	BP-EP-01C-JB-Z1-USCG	1
Generic Drawing	Junction Box - Flow Meter ISB (Distributed configuration)	BP-EP-50-JB-ISB-USCG	1

Generic Drawing	Junction Box - Electrolyzer Skid (Distributed configuration)	BP-JB-01-USCG	0
Generic Drawing	Junction Box - Power Supply Skid (Distributed configuration)	BP-JB-10-USCG	1
Generic Drawing	Equipment Layout Flow Diagram BP6 (Hybrid configuration)	BP6-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP6 (Hybrid configuration)	BP6-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP6 (Hybrid configuration)	BP6-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP8 (Hybrid configuration)	BP8-F-50-H-USCG	0
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP8 (Hybrid configuration)	BP8-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP8 (Hybrid configuration)	BP8-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP12 (Hybrid configuration)	BP12-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP12 (Hybrid configuration)	BP12-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP12 (Hybrid configuration)	BP12-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP24 (Hybrid configuration)	BP24-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP24 (Hybrid configuration)	BP24-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP24 (Hybrid configuration)	BP24-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP36 (Hybrid configuration)	BP36-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP36 (Hybrid configuration)	BP36-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP36 (Hybrid configuration)	BP36-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP48 (Hybrid configuration)	BP48-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP48 (Hybrid configuration)	BP48-P-01-H-USCG	0
Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP48 (Hybrid configuration)	BP48-P-02-H-USCG	0
Generic Drawing	Equipment Layout Flow Diagram BP60 (Hybrid configuration)	BP60-F-50-H-USCG	1
Generic Drawing	General Arrangement – Electrolyzer, Blower, Degas Separator, Vent Stack & Power Supply Skid BP60 (Hybrid configuration)	BP60-P-01-H-USCG	0

Generic Drawing	General Arrangement – Strainer & Booster Pump Skid BP60 (Hybrid configuration)	BP60-P-02-H-USCG	0
Generic Drawing	Electrical Single Line Diagram (Hybrid configuration)	BP-ESL-H-Z1-USCG	1
Generic Drawing	Electrical Interconnect (On Skid) (Hybrid configuration)	BP-E-01-H-USCG	1
Generic Drawing	Electrical Interconnect (Skid to Skid) (Hybrid configuration)	BP-E-50-H-Z1-USCG	1
Generic Drawing	Control Architecture (Hybrid configuration)	BP-E-75-ARCH-H-Z1-USCG	0
Generic Drawing	Interconnect - Network Communication (Hybrid configuration)	BP-E-75-H-Z1-USCG	0
Generic Drawing	Electrical Panel - Electrolyzer Skid (Main Control Panel Layout Diagram) (Hybrid configuration)	BP-EP-01C-H-Z1-USCG	1
Generic Drawing	Electrical Panel - Booster Pump Skid (1 Booster Pump) (Hybrid configuration)	BP-EP-02-H-USCG	1
Generic Drawing	Electrical Panel - Blower/Vent Stack Skid (2 Blowers) (Hybrid configuration)	BP-EP-03-H-USCG	1
Generic Drawing	Electrical Panel - Analyzer / Neutralization Skid (Hybrid configuration)	BP-EP-04-H-USCG	1
Generic Drawing	Electrical Panel – Filter FWD- Forward, AFT- Aft Peak Tank, PORT- Port, STBD- Starboard (FWD may be substituted with PORT or STBD dependent on vessel configuration) (Hybrid configuration)	BP-EP-21-FWD-H-Z1-USCG	1
Generic Drawing	Electrical Panel - Cargo Control Room Remote (Hybrid configuration)	BP-EP-50-H-Z1-USCG	1
Generic Drawing	Junction Box - Main Control Panel (Hybrid configuration)	BP-EP-01C-JB-H-Z1-USCG	1
Generic Drawing	Junction Box – Neutralization (Hybrid configuration)	BP-EP-04-JB-H-USCG	0
Generic Drawing	Junction Box - Flow Meter ISB (Hybrid configuration)	BP-EP-50-JB-ISB-H-USCG	1
Generic Drawing	Equipment Layout Assembly Details (Distributed and Hybrid configurations)	BP-DTL-50-STD	1
Generic Drawing	General Arrangement – Analyzer / Neutralization Skid (Distributed and Hybrid configurations)	BP-P-04-22-USCG	1
Component list	BILL OF MATERIALS BP6 - HYBRID CONFIGURATION	BP6-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP6 – DISTRIBUTED CONFIGURATION	BP6-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship loose) BP6 - DISTRIBUTED & HYBRID CONFIGURATIONS	BP6-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP8 - HYBRID CONFIGURATION	BP8-LST-BOM-MECH-H-MCA	2

Component list	BILL OF MATERIALS BP8 - DISTRIBUTED CONFIGURATION	BP8-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP8-DISTRIBUTED & HYBRID CONFIGURATIONS	BP8-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP12 - HYBRID CONFIGURATION	BP12-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP12 - DISTRIBUTED CONFIGURATION	BP12-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP12-DISTRIBUTED & HYBRID CONFIGURATIONS	BP12-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP24 - HYBRID CONFIGURATION	BP24-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP24- DISTRIBUTED CONFIGURATION	BP24-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP24-DISTRIBUTED & HYBRID CONFIGURATIONS	BP24-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP36 - HYBRID CONFIGURATION	BP36-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP36 - DISTRIBUTED CONFIGURATION	BP36-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP36-DISTRIBUTED & HYBRID CONFIGURATIONS	BP36-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP48 - HYBRID CONFIGURATION	BP48-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP48 - DISTRIBUTED CONFIGURATION	BP48-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP48 - DISTRIBUTED & HYBRID CONFIGURATIONS	BP48-LST-BOM-SHLS-MCA	2
Component list	BILL OF MATERIALS BP60 - HYBRID CONFIGURATION	BP60-LST-BOM-MECH-H-MCA	2
Component list	BILL OF MATERIALS BP60 - DISTRIBUTED CONFIGURATION	BP60-LST-BOM-MECH-M-MCA	2
Component list	BILL OF MATERIALS (Ship Loose) BP60 - DISTRIBUTED & HYBRID CONFIGURATIONS	BP60-LST-BOM-SHLS-MCA	2
Component list	BALPURE® BP-8 BWMS – Type Approved & Environmentally Tested Components List	BP8-LST-ELECT-TA-ENVTESTED	5
Component list	BALPURE® BWMS – Hazardous Area Rated Components List	BP-LST-HAZ-COMP	3
Component list	Type Approved Plastic Piping, Fittings and Valves for BALPURE® BWMS	BP-LST-PIPE-PLS	0
BWMS Models List	BALPURE® Models Matrix	BP-LST-BALPUREMATRIX-USCG	4
BW Filters for BWMS	Ballast Water Filters for BALPURE® Ballast Water Treatment System	BP-RPT-FILTERMATRIX-USCG	5

PRODUCT DESCRIPTION

De Nora Marine Technologies' BLAPURE® BWMS uses Filtration and side stream Electro-chlorination technology.

BALPURE® BWMS Treatment processes include:

- Ballast Uptake- Filtration of main flow, side stream production of Solidum Hypochlorite and injection into the main flow
- Ballast Discharge- Injection of Neutralisation Agent into the treated discharge flow (if required)

SYSTEM DESIGN LIMITATIONS

This BWMS has been designed for operation in the following conditions:

Parameter	Operational Range
Temperature of feed water to electrolysis cells	> 15°C (Nominal with Warning alarm) >8°C (Alarm and Shut down)
Salinity of feed water to electrolysis cells	> 18 PSU
Minimum and maximum TRO set point during ballasting	7 ppm (min.) and 15 ppm (max.)
Minimum holding time	24 hours
Minimum filter outlet pressure (during back-flushing only)	≥ 1.5 barg – Hydac Filter ≥ 1.6 barg- Filtersafe filter

Temperature

The BALPURE® BWMS has been found to hold no limitations of ballast water temperature, as validated during Land-based and Shipboard testing.

However, the process feed water should be taken from a source with >15 °C or heated to such temperature.

Salinity

The BALPURE® BWMS has been found to hold no limitation with the salinity of ballast water, as validated during Land-based and Shipboard testing. However, the process feed water should be taken from a source with >18PSU salinity. Feed water can come from three locations:

1. using in-line booster pumps to feed less than 1% of the total incoming ballast water flow as a side-stream off the main ballast line; or
2. Using in-line booster pumps to feed seawater from engine room cooling outlet or sea chest directly to the electrolyser through a strainer which removes any particles larger than 800 microns; or
3. Using in-line booster pumps to feed seawater from the aft peak ballast tank through a strainer.

Post-treatment Holding Time

The BALPURE® BWMS has been found to require twenty-four (24) hours post treatment holding time. As validated by land based and Shipboard testing.

Treatment Rated Capacities (TRC)¹⁾

BALPURE® Production Model	BALPURE® Options Based on Ballast Flow**	Treatment Rated Capacity (TRC)	Filter Models
		(m ³ /h)	Filtersafe*** Hydac
BP-60*	BP8570-AL	8,570	Filtersafe: 3x BS-1004H(or V)-T; 3x BS-1004E-H(or V)-T; 3x BS-1204H(or V); 3x BS-1204E-H(or V); 3x BS-1206H(or V); 3x BS-1206E-H(or V); 4x BS-804H(or V)-T; 4x BS-804E-H(or V)-T; 4x BS-1004H(or V); 4x BS-1004E-H(or V) Hydac: 3x RF10-60; 3x RF3-8; 4x RF3-7; 3x RF10-55; 4x RF10-50
	BP7500-A	7,500	Filtersafe: 3x BS-1004H(or V); 3x BS-1004E-H(or V); 2x BS-1406H(or V)-T; 2x BS-1406E-H(or V)-T; 4x BS-804H(or V); 4x BS-804E-H(or V); 3x BS-1004H(or V)-T; 3x BS-1004E-H(or V)-T; 3x BS-1204H(or V); 3x BS-1204E-H(or V); 3x BS-1206H(or V); 3x BS-1206E-H(or V) Hydac: 3x RF3-7; 3x RF10-55; 4x RF10-50
	BP7200-A	7,200	Filtersafe: 2x BS-1204H(or V)-T; 2x BS-1204E-H(or V)-T; 2x BS-1206H(or V)-T; 2x BS-1206E-H(or V)-T; 2x BS-1406H(or V)-T; 2x BS-1406E-H(or V)-T; 3x BS-804H(or V)-T; 3x BS-804E-H(or V)-T; 3x BS-1004H(or V); 3x BS-1004E-H(or V); 4x BS-804H(or V); 4x BS-804E-H(or V); 3x BS-1004H(or V)-T; 3x BS-1004E-H(or V)-T Hydac: 3x RF10-55; 4x RF10-50; 3x RF3-7
	BP6800-A	6,800	Filtersafe: 2x BS-1204H(or V)-T; 2x BS-1204E-H(or V)-T; 2x BS-1206H(or V)-T; 2x BS-1206E-H(or V)-T; 2x BS-1406H(or V); 2x BS-1406E-H(or V); 3x BS-804H(or V)-T; 3x BS-804E-H(or V)-T; 3x BS-1004H(or V); 3x BS-1004E-H(or V); 4x BS-804H(or V); 4x BS-804E-H(or V) Hydac: 2x RF10-60; 2x RF3-8; 3x RF3-7
	BP6400-B	6,400	Filtersafe: 2x BS-1204H(or V)-T; 2x BS-1204E-H(or V)-T; 2x BS-1206H(or V)-T; 2x BS-1206E-H(or V)-T; 2x BS-1406H(or V); 2x BS-1406E-H(or V); 3x BS-1004H(or V); 3x BS-1004E-H(or V); 3x BS-804H(or V)-T; 3x BS-804E-H(or V)-T Hydac: 2x RF10-60; 2x RF3-8; 3x RF3-7; 3x RF10-50
	BP5000-C	5,000	Filtersafe: 2x BS-1004H(or V); 2x BS-1004E-H(or V)-T; 2x BS-1004H(or V); 2x BS-1204E-H(or V); 2x BS-1206H(or V); 2x BS-1206E-H(or V); 3x BS-603H(or V)-T; 3x BS-603E-H(or V)-T; 3x BS-804H(or V); 3x BS-804H(or V)-T; 3x BS-804E-H(or V); 3x BS-804E-H(or V)-T Hydac: 2x RF3-7; 2x RF10-55
	BP4000-D	4,000	Filtersafe: BS-1406H(or V)-T; BS-1406E-H(or V)-T; 2x BS-804H(or V); 2x BS-804H(or V)-T; 2x BS-804E-H(or V); 2x BS-804E-H(or V)-T; 3x BS-603H(or V); 3x BS-603E-H(or V); 3x BS-500H(or V)-T; 3x BS-500E-H(or V)-T Hydac: 2x RF10-50; 3x RF10-40; 3x RF3-6; 2x RF3-7

BP-48*	BP6860-AL	6,860	Filtersafe: 2x BS-1204H(or V)-T; 2x BS-1204E-H(or V)-T; 2x BS-1206H(or V)-T; 2x BS-1206E-H(or V)-T; 2x BS-1406H(or V); 2x BS-1406E-H(or V); 3x BS-804H(or V)-T; 3x BS-804E-H(or V)-T; 3x BS-1004H(or V); 3x BS-1004E-H(or V); 4x BS-804H(or V); 4x BS-804E-H(or V) Hydac: 2x RF10-60; 2x RF3-8; 3x RF3-7
	BP6000-A	6,000	Filtersafe: 2x BS-1004H(or V)-T; 2x BS-1004E-H(or V)-T; 2x BS-1204H(or V); 2x BS-1204E-H(or V); 2x BS-1206H(or V); 2x BS-1206E-H(or V); 3x BS-804H(or V); 3x BS-804E-H(or V); 2x BS-1204H(or V)-T; 2x BS-1204E-H(or V)-T; 2x BS-1406H(or V); 2x BS-1406E-H(or V); 3x BS-804H(or V)-T; 3x BS-804E-H(or V)-T Hydac: 2x RF10-60; 2x RF3-8; 3x RF3-7; 2x RF10-55; 3x RF10-50
	BP5100-B	5,100	Filtersafe: 2x BS-1004H(or V)-T; 2x BS-1004E-H(or V)-T; 2x BS-1204H(or V); 2x BS-1204E-H(or V); 2x BS-1206H(or V); 2x BS-1206E-H(or V); 3x BS-603H(or V)-T; 3x BS-603E-H(or V)-T; 3x BS-804H(or V); 3x BS-804E-H(or V); 3x BS-804E-H(or V)-T Hydac: 2x RF10-55; 3x RF10-50; 2x RF3-8
	BP5000-B	5,000	Filtersafe: 2x BS-1004H(or V); 2x BS-1004E-H(or V)-T; 2x BS-1004E-H(or V); 2x BS-1004E-H(or V)-T; 2x BS-1204H(or V); 2x BS-1204E-H(or V); 2x BS-1206H(or V); 2x BS-1206E-H(or V); 3x BS-603H(or V)-T; 3x BS-603E-H(or V)-T; 3x BS-804H(or V); 3x BS-804E-H(or V)-T; 3x BS-804E-H(or V); 3x BS-804E-H(or V)-T Hydac: 2x RF3-7; 2x RF10-55
	BP4000-C	4,000	Filtersafe: BS-1406H(or V)-T; BS-1406E-H(or V)-T; 2x BS-804H(or V); 2x BS-804E-H(or V)-T; 2x BS-804E-H(or V); 2x BS-804E-H(or V)-T; 3x BS-603H(or V); 3x BS-603E-H(or V); 3x BS-500H(or V)-T; 3x BS-500E-H(or V)-T Hydac: 2x RF10-50; 3x RF10-40; 3x RF3-6; 2x RF3-7
	BP3200-D	3,200	Filtersafe: BS-1406H(or V); BS-1406H(or V)-T; BS-1406E-H(or V); BS-1406E-H(or V)-T; BS-1204H(or V)-T; BS-1204E-H(or V)-T; BS-1206H(or V)-T; BS-1206E-H(or V)-T; 2x BS-603H(or V)-T; 2x BS-603E-H(or V)-T Hydac: RF10-60; RF3-8; 2x RF3-6; 3x RF10-36
BP-36*	BP5140-AL	5,140	Filtersafe: 2x BS-1004H(or V)-T; 2x BS-1004E-H(or V)-T; 2x BS-1204H(or V); 2x BS-1204E-H(or V); 2x BS-1206H(or V); 2x BS-1206E-H(or V); 3x BS-603H(or V)-T; 3x BS-603E-H(or V)-T; 3x BS-804H(or V); 3x BS-804E-H(or V)-T; 3x BS-804E-H(or V); 3x BS-804E-H(or V)-T Hydac: 2x RF10-55; 3x RF10-50; 2x RF3-8
	BP4500-A	4,500	Filtersafe: 2x BS-804H(or V)-T; 2x BS-804E-H(or V)-T; 3x BS-500H(or V)-T; 3x BS-500E-H(or V)-T; 3x BS-603H(or V); 3x BS-603E-H(or V) Hydac: 2x RF3-7; 3x RF3-6; 3x RF10-40

	BP4000-A	4,000	Filtersafe: BS-1406H(or V)-T; BS-1406E-H(or V)-T; 2x BS-804H(or V); 2x BS-804H(or V)-T; 2x BS-804E-H(or V); 2x BS-804E-H(or V)-T; 3x BS-603H(or V); 3x BS-603E-H(or V); 3x BS-500H(or V)-T; 3x BS-500E-H(or V)-T Hydac: 2x RF10-50; 3x RF10-40; 3x RF3-6; 2x RF3-7
	BP3850-B	3,850	Filtersafe: 2x BS-804H(or V); 2x BS-804E-H(or V); BS-1406H(or V)-T; BS-1406E-H(or V)-T; 3x BS-603H(or V); 3x BS-603E-H(or V) Hydac: 2x RF10-50; 3x RF10-36
	BP3000-C	3,000	Filtersafe: BS-1204H(or V); BS-1204H(or V)-T; BS-1204E-H(or V); BS-1204E-H(or V)-T; BS-1206H(or V); BS-1206H(or V)-T; BS-1206E-H(or V); BS-1206E-H(or V)-T; BS-1004H(or V)-T; BS-1004E-H(or V)-T; 2x BS-500H(or V)-T; 2x BS-500E-H(or V)-T; 2x BS-603H(or V); 2x BS-603E-H(or V) Hydac: RF10-55; RF10-60; RF3-8; 2x RF10-40
	BP2400-D	2,400	Filtersafe: BS-804H(or V)-T; BS-804E-H(or V)-T; BS-1004H(or V); BS-1004H(or V)-T; BS-1004E-H(or V); BS-1004E-H(or V)-T; 2x BS-400H(or V)-T; 2x BS-400E-H(or V)-T; 2x BS-500H(or V); 2x BS-500E-H(or V); BS-1204H(or V); BS-1204E-H(or V); BS-1206H(or V); BS-1206E-H(or V); 2x BS-603H(or V); 2x BS-603E-H(or V); 2x BS-500H(or V)-T; 2x BS-500E-H(or V)-T Hydac: RF3-7; RF10-55; 2x RF10-36; 2x RF10-40
BP-24*	BP3430-AL	3,430	Filtersafe: BS-1406H(or V); BS-1406H(or V)-T; BS-1406E-H(or V); BS-1406E-H(or V)-T; BS-1204H(or V)-T; BS-1204E-H(or V)-T; BS-1206H(or V)-T; BS-1206E-H(or V)-T; 2x BS-603H(or V)-T; 2x BS-603E-H(or V)-T Hydac: RF10-60; RF3-8; 3x RF10-36; 3x RF3-5
	BP3000-A	3,000	Filtersafe: BS-1204H(or V); BS-1204H(or V)-T; BS-1204E-H(or V); BS-1204E-H(or V)-T; BS-1206H(or V); BS-1206H(or V)-T; BS-1206E-H(or V); BS-1206E-H(or V)-T; BS-1004H(or V)-T; BS-1004E-H(or V)-T; 2x BS-500H(or V)-T; 2x BS-500E-H(or V)-T; 2x BS-603H(or V); 2x BS-603E-H(or V) Hydac: RF10-55; RF10-60; RF3-8; 2x RF10-40
	BP2500-B	2,500	Filtersafe: BS-1004H(or V); BS-1004H(or V)-T; BS-1004E-H(or V); BS-1004E-H(or V)-T; 2x BS-500H(or V); 2x BS-500E-H(or V); 2x BS-603H(or V); 2x BS-603E-H(or V); BS-1204H(or V); BS-1204E-H(or V); BS-1206H(or V); BS-1206E-H(or V); 2x BS-500H(or V)-T; 2x BS-500E-H(or V)-T Hydac: RF3-7; RF10-55; 2x RF10-40; 2x RF10-36
	BP2400-D	2,400	Filtersafe: BS-804H(or V)-T; BS-804E-H(or V)-T; BS-1004H(or V); BS-1004H(or V)-T; BS-1004E-H(or V); BS-1004E-H(or V)-T; 2x BS-400H(or V)-T; 2x BS-400E-H(or V)-T; 2x BS-500H(or V); 2x BS-500E-H(or V); BS-1204H(or V); BS-1204E-H(or V); BS-1206H(or V); BS-1206E-H(or V); 2x BS-603H(or V); 2x BS-603E-H(or V); 2x BS-500H(or V)-T; 2x BS-500E-H(or V)-T Hydac: RF3-7; RF10-55; 2x RF10-36; 2x RF10-40

	BP2000-C	2,000	Filtersafe: BS-804H(or V); BS-804H(or V)-T; BS-804E-H(or V); BS-804E-H(or V)-T; 2x BS-400H(or V); 2x BS-400H(or V)-T; 2x BS-400E-H(or V); 2x BS-400E-H(or V)-T; 2x BS-500H(or V); 2x BS-500E-H(or V) Hydac: RF10-50; RF3-7; 2x RF10-35; 2x RF10-36
	BP1600-D	1,600	Filtersafe: BS-804H(or V); BS-804H(or V)-T; BS-804E-H(or V); BS-804E-H(or V)-T; BS-603H(or V)-T; BS-603E-H(or V)-T; 2x BS-300H(or V)-T; 2x BS-300E-H(or V)-T; 2x BS-400H(or V); 2x BS-400E-H(or V) Hydac: RF10-50; 2x RF10-35; 2x RF3-4; RF3-6
BP-12*	BP1710-AL	1,710	Filtersafe: BS-804H(or V); BS-804H(or V)-T; BS-804E-H(or V); BS-804E-H(or V)-T; BS-603H(or V)-T; BS-603E-H(or V)-T; 2x BS-300H(or V)-T; 2x BS-300E-H(or V)-T; 2x BS-400H(or V); 2x BS-400E-H(or V) Hydac: RF10-50; 2x RF10-35
	BP1500-A	1,500	Filtersafe: BS-500H(or V)-T; BS-500E-H(or V)-T; BS-603H(or V); BS-603E-H(or V); 2x BS-300H(or V); 2x BS-300E-H(or V); BS-603H(or V)-T; BS-603E-H(or V)-T; 2x BS-300H(or V)-T; 2x BS-300E-H(or V)-T; BS-804H(or V); BS-804E-H(or V); 2x BS-400H(or V); 2x BS-400E-H(or V) Hydac: RF10-40; 2x RF10-35; 2x RF10-30; 2x RF3-4; RF3-6
	BP1250-B	1,250	Filtersafe: BS-500H(or V); BS-500E-H(or V); BS-603H(or V); BS-603E-H(or V); 2x BS-300H(or V); 2x BS-300E-H(or V) Hydac: RF10-36; RF10-40; 2x RF10-30; RF3-6
	BP1000-C	1,000	Filtersafe: BS-400 H (or V); BS-400H (or V)-T; BS-400E- H (or V); BS-400E-H(or V)-T; 2x BS-200H (or V); 2x BS-200H (or V)-T; 2x BS-201H (or V); 2x BS-201E-H (or V); 2x BS-201H (or V)-T; 2x BS-201E-H (or V)-T; BS-500H (or V); BS-400E-H (or V) Hydac: RF10-35; RF10-36; 2x RF-25; RF3-5
	BP800-D	800	Filtersafe: BS-300H(or V)-T; BS-300E-H(or V)-T; BS-400H(or V); BS-400H(or V)-T; BS-400E-H(or V); BS-400E-H(or V)-T; 2x BS-201H(or V); 2x BS-201E-H(or V); 2x BS-200H(or V); 2x BS-200H(or V)-T; 2x BS-151H(or V)-T; 2x BS-151E-H(or V)-T Hydac: RF10-35; 2x RF10-23; RF3-5; RF3-4
BP-8*	BP1140-AL	1,140	Filtersafe: BS-400H(or V)-T ; BS-400E-H(or V)-T ; 2x BS-201H(or V)-T ; 2x BS-201E-H(or V)-T ; BS-500H(or V) ; BS-500E-H(or V) ; BS-603H(or V); BS-603E-H(or V); 2x BS-300H(or V); 2x BS-300E-H(or V) Hydac: RF10-36; RF10-40; RF3-5; 2x RF10-30
	BP1000-A	1,000	Filtersafe: BS-400 H (or V); BS-400H (or V)-T; BS-400E- H (or V); BS-400E-H(or V)-T; 2x BS-200H (or V); 2x BS-200H (or V)-T; 2x BS-201H (or V); 2x BS-201E-H (or V); 2x BS-201H (or V)-T; 2x BS-201E-H (or V)-T; BS-500H (or V); BS-400E-H (or V) Hydac: RF10-35; RF10-36; 2x RF-25; RF3-5

	BP850-B	850	Filtersafe: BS-300H(or V)-T; BS-300E-H(or V)-T; BS-400H(or V); BS-400H(or V)-T; BS-400E-H(or V); BS-400E-H(or V)-T; 2x BS-201H(or V); 2x BS-201E-H(or V); 2x BS-200H(or V); 2x BS-200H(or V)-T; 2x BS-151H(or V)-T; 2x BS-151E-H(or V)-T Hydac: RF10-35; 2x RF10-23; RF3-5; RF3-4
	BP675-C	675	Filtersafe: BS-300H (or V); BS-300H (or V)-T; BS-300E-H (or V); BS-300E-H (or V)-T; BS-400 H (or V); BS-400E- H (or V); 2x BS-151H (or V); 2x BS-151E-H (or V); 2x BS-150H (or V) Hydac: RF10-30; RF10-35; 2x RF10-23; RF3-4
	BP500-D	500	Filtersafe: BS-201H (or V); BS-201E-H (or V); BS-200H (or V); BS-200H (or V)-T; BS-201H (or V)-T; BS-201E-H (or V)-T; BS-300H (or V); BS-300E-H (or V); 2x BS-101H (or V); BS-101E-H (or V); 2x BS-101H (or V)-T; 2x BS-101E-H (or V)-T; 2x BS-100H (or V); 2x BS-100H (or V)-T Hydac: RF10-25; 2x RF10-20; RD10-30; RF3-4; 2x RF3-2.5
BP-6*	BP850-AL	850	Filtersafe: BS-300H (or V)-T BS-300E-H (or V); BS-400 H (or V); BS-400H (or V)-T; BS-400E- H (or V); BS-400E-H(or V)-T; 2x BS-201H (or V); 2x BS-201E-H (or V); 2x BS-200H (or V); 2x BS-200H (or V)-T; 2x BS-151H (or V)-T; 2x BS-151E-H (or V)-T Hydac: RF10-35; 2x RF10-23; RF3-5; RF3-4
	BP750-A	750	Filtersafe: BS-300H (or V); BS-300H (or V)-T BS-300E-H (or V); BS-300E-H (or V)-T; BS-400 H (or V); BS-400H (or V)-T; BS-400E- H (or V); BS-400E-H (or V)-T; 2x BS-201H (or V); 2x BS-201E-H (or V); 2x BS-200H (or V); 2x BS-200H (or V)-T; 2x BS-151H (or V)-T; 2x BS-151E-H (or V)-T Hydac: RF10-30; RF10-35; 2x RF10-23; RF3-5; RF3-4
	BP630-B	630	Filtersafe: BS-300H (or V); BS-300H (or V)-T BS-300E-H (or V); BS-300E-H (or V)-T; BS-400 H (or V); BS-400E- H (or V); 2x BS-151H (or V); 2x BS-151E-H (or V); 2x BS-150H (or V) Hydac: RF10-30; RF10-35; 2x RF10-23; RF3-4
	BP500-C	500	Filtersafe: BS-201H (or V); BS-201E-H (or V); BS-200H (or V); BS-200H (or V)-T; BS201H (or V)-T; BS-201E-H (or V)-T; BS-300H (or V); BS-300E-H (or V); 2x BS-101H (or V); BS-101E-H (or V); 2x BS-101H (or V)-T; 2x BS-101E-H (or V)-T; 2x BS-100H (or V); 2x BS-100H (or V)-T Hydac: RF10-25; 2x RF10-20; RD10-30; RF3-4; 2x RF3-2.5
	BP400-D	400	Filtersafe: BS-150H(or V)-T; BS-151H(or V)-T; BS-151E- H (or V)-T; BS-201H (or V); BS-201E-H (or V); BS-200H (or V); 2x BS-100H (or V); 2x BS-100H (or V) -T; 2x BS-101H (or V); 2x BS-101E-H (or V); 2x BS-101H (or V)-T; 2x BS-101E-H (or V)-T Hydac: RF10-23; RF10-25; 2x RF10-20; RF3-3; 2x RF3-2.5

Aft Peak Filter Models for all Type Approved BALPURE® BWMS	Aft Peak Water treatment	50-1,500	<p>Filtersafe: BS-031H(or V); BS-061H(or V); BS-061H(or V)-T; BS-101H(or V); BS-101H(or V)-T; BS-101E-H(or V); BS-101E-H(or V)-T; BS-151H(or V); BS-151H(or V)-T; BS-151E-H(or V); BS-151E-H(or V)-T; BS-201H(or V); BS-201H(or V)-T; BS-201E-H(or V); BS-201E-H(or V)-T BS-300H(or V); BS-300H(or V)-T; BS-300E-H(or V); BS-300E-H(or V)-T; BS-400H(or V); BS-400H(or V)-T; BS-400E-H(or V); BS-400E-H(or V)-T BS-500H(or V); BS-500H(or V)-T BS-500E-H(or V) BS-500E-H(or V)-T; BS-025H(or V); BS-050H(or V); BS-070H(or V); BS-100H(or V); BS-150H(or V); BS-200H(or V); BS-100H(or V)-T; BS-150H(or V)-T; BS-200H(or V)-T</p> <p>Hydac: RF3-2; RF3-2.5; RF3-3; RF3-4; RF3-5; RF10-10; RF10-20; RF10-23; RF10-25; RF10-30; RF10-35</p>
Comments:	<p>* Number indicates BALPURE® Electrolyser's Sodium hypochlorite Production Capacity in kilograms per hour ** Max. Concentration Dosage of Active Substance: AL = 7 ppm; A = 8-9 ppm; B = 9.5-10 ppm; C = 12 ppm, D = 15 ppm *** For filters, V = Vertical Configuration, H = Horizontal Configuration, T = Turbo, E= Evolution - Additional technical details (e.g., operation in hazardous area "Zone 0") can be found in the Manufacturer's Manual.</p>		

- 1) TRC is the maximum inlet flow to the BWMS; a flow exceeding the given value implies that the ballast water is not treated in accordance with this certificate

SHIP-SPECIFIC COMPONENTS DESIGN/ SELECTION

Sensors

The BALPURE® BWMS must be installed with an uptake ballast water flow meter, side stream water flow meter, side steam feed water temperature and salinity sensors. The BALPURE® BWMS must be installed with either TRO analyzers or ORP sensors as per the generic drawings and Bill of Materials.

Control equipment

The type approved system includes the following control unit(s):

Name	Model	Maker	Software revision
Programable Logic Computer (PLC) Option 1: Compact base M258 - 42 I/O - 24 VDC Option 2: Logic Controller M262	Option 1: TM258LD42DT Option 2: TM262L10MESE8T	MODICON	PLC Programming Software Option 1: SoMachine 4.3 Option 2: EcoStruxure 1.2
Human Machine Interface (HMI) Option 1: HMI, 10.4" TFT, 96MB, Magelis Option 2: HMI Display Only, 10.4" TFT + Open Box for Universal Panel	Option 1: HMIGTO5310 Option 2: HMIDT542 + HMIG5U	SCHNEIDER ELECTRIC	HMI Programming Software: Vijeo Designer version 6.2
Data Logger Option 1: Model DS ZR Option 2: Model GRAC0001	Option 1: DAE-STDN-DATLOGUSB-0615 Option 2: DAE-GRAC-DATLOGUSB-0119	RED LION	Option 1: Crimson 3.0 Option 2: Crimson 3.1

SHIP-SPECIFIC BWMS INSTALLATION REQUIREMENTS

The additional documentation to be submitted for approval in each BWMS installation includes:

- Piping and Instrumentation Diagram (P&ID) of the ballast system;
- Ballast water pump details;
- BWMS piping and valve arrangement deliverables;
- Bill of material list of BWMS.



APPRAISED DOCUMENTATION

Document No.	Rev.	Title	Date
BP-MAN-OPR-MCA	1	BALPURE® BWMS Operation, Maintenance, & Safety Manual	15 Oct 2020
CP00371-RSK-ASMT	0	BALPURE® RISK ASSESSMENT CRUDE OIL TANKERS	27 Apr 2017
CP00422-RSK-ASMT	0	BALPURE® RISK ASSESSMENT OIL / CHEMICAL TANKERS	17 Oct 2017
BP-RPT-SCALING-IMO	5	BALPURE® Scaling report – Information to Support Capacity Claims for BALPURE® BP-6 to BP-60 BWMS Models	1 Oct 2020
BP-RPT-CLAIMS-IMO	1	BALPURE® BWMS – Operational Ranges, Claims & Claim Verification Methods (System Design Limitations)	21 Mar 2019
BP-QA-SQP	0	BALPURE® Ballast Water Treatment System Software Quality Assurance (SQA) Plan	15 Aug 2017
BP-RPT-CLAIMS-TEMP	0	DNWT's Paper on Ambient Water Temperature Claims of BALPURE® BWMS	12 Feb 2019

BIOLOGICAL TEST REPORTS

Document No.	Rev.	Title	Date
7230-2018	6.0	Shipboard testing of the Ballast Water Management System BALPURE of De Nora Water Technologies. Final report.	Jan 2018
7210-2017	8.0	Land based testing of the BALPURE® Ballast Water Management System of De Nora Water Technologies. Final report.	08 Nov 2019
7300-2018	2.0	Land-based testing of the BALPURE® Ballast Water Management System of De Nora Water Technologies using an alternate Ballast Water Filter. Final report.	20 Aug 2018
7495-2020 (revised version of 7476-2020, rev. 2.0)	-	Additional Land-based testing of the BALPURE® Ballast Water Management System of De Nora Water Technologies for the IMO Revised G8 Type Approval	06 Apr 2020
MEPC 61/2/21, annex 7	-	Final Approval based on Seawater and Brackish water test results.	27 Aug 2010
MEPC 75/WP.1 Section 4.3	-	MEPC final approval fresh water	20 Nov 2020

ENVIRONMENTAL TEST REPORTS

Document No.	Rev.	Title	Date
NK1376-1	2	Test Report	05 Apr 2011
EK1376-1	2	Diagnostic Test Report	04 May 2011
U124896E1	--	Test Report	22 Oct 2012
E124896E1	--	Test Report	08 Feb 2013
REPO-0683	2	Type Test Report	25 Oct 2013
EO0392-1	1	Test report for BP-EP-50-LR and BP3000-EP-21-PORT-LR Electrical Panels	23 June 2014
NO0392-1	1	Test Report for BP-EP-50-LR and BP3000-EP-21-PORT-LR Electrical Panels	12 Sep2014
EN0962-1	1	Test Report for Electrical Panels (EP-01C, EP-02, EP-03, EP-01M, EP-04) and Hydrogen sensor (FP-424C).	22 Nov 2013
NN0962-1	1	Test Report for Electrical Panels (EP-01C, EP-02, EP-03, EP-01M, EP-04) and Hydrogen sensor (FP-424C).	20 Nov 2013
ER3227-1	2	Test report for Flow switch, ORP transmitters and ORP sensors	14 Aug 2018
NR3227-1	1	Test report for Flow switch, ORP transmitters and ORP sensors	16 May 2018
20987	1	Test Report for Filtersafe Filter Control Cabinet	21 Feb 2017

SYSTEM SUPPORTING REPORTS

Document No.	Rev.	Title	Date
UKITSO/382449 79/ENG-BAL	0	Electro-chlorination Cells - Machinery General Design Appraisal (MGDA) Document	13 Mar 2020

CONDITIONS OF APPROVAL

1. For each BALPURE® BWMS installation, the minimum flow rate selected and approved should take into account ship stability requirements (i.e. loading manual).
2. The 'Additional documentation', as described in section 'SHIP-SPECIFIC BWMS INSTALLATION REQUIREMENTS' of this certificate, is to be submitted for approval in each BALPURE® installation.
3. All changes in software are to be recorded in accordance the approved Software Quality Plan. The records of all changes are to be forwarded to Lloyd's Register for evaluation and approval. Major changes to the software are to be approved before installed.
4. For installation of equipment in a hazardous area, appropriate documentation is to be submitted for evaluation and approval to show that the relevant equipment is certified as being safe for use in hazardous areas, as defined in IEC 60079-10-1.
5. The alarm in all control stations of ballast water operation including the navigation bridge need to be verified at installation commissioning of the ballast water management system.

CONDITIONS OF CERTIFICATION

De Nora Marine Technologies hereafter referred as licensee

1. The licensee must take reasonable measures to ensure that the operator of the system is familiar with the operation of the system and is capable of operating and maintaining the system in accordance with the BALPURE® BWMS Operation, Maintenance, and Safety Manual (OMSM).
2. Significant changes in the construction of the ballast water management system must be reported to both the MCA and the recognised organisation that issued the type approval certificate on behalf of the MCA; if they potentially affect the efficiency of the system, they must be approved by the MCA.
3. Any indications that the ballast water management system is not performing to the standards of the ballast water convention must be reported to the MCA including any deficiencies identified by Port State control.
4. The licensee must report immediately all events to the MCA leading to harm either to human health or the environment as a result of the operation of the ballast water management system.
5. All accidents in connection with the ballast water management system must be reported immediately to the MCA.
6. If the licensee does not comply with these additional provisions, the type approval may be revoked by the MCA.



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ANNEX 1 – SUMMARY OF TESTING

Summary of land-based testing for BALPURE® BP-8 at rated flow rate of 300 m³/h:

Table 1 Inlet Test water conditions in Fresh, Brackish and Marine water Test Cycles

Test Cycle	Flow rate [m ³ /h]	Holding Time [hours]	Challenge Water Temperature [°C]	Challenge Water Salinity [PSU]	Challenge Water DOC [mg/L]	Challenge Water POC [mg/L]	Challenge Water TSS [mg/L]	Energy Consumption [Wh/ m ³]
Primary Filter testing (7210-2017 v.8)								
1	311	25	14.4	31.9	6.6	7.6	52.2	-
2	313	24	14.6	32.0	6.7	7.4	51.4	-
3	302	24	11.4	32.5	5.4	8.9	38.9	30.5
4	287	24	11.6	32.7	5.3	10.6	43.6	35.6
5	304	24	11.7	30.8	6.4	6.1	38.2	30.0
6	307	23	12.0	30.3	6.2	6.3	35.9	28.8
7	308	26	12.5	29.2	6.1	6.7	34.8	36.9
8	307	25	12.5	29.5	6.1	7.5	37.1	28.9
9	306	24	17.4	0.4	8.6	9.4	58.0	38.7
10	308	24	17.7	0.4	8.6	9.3	63.5	36.1
11	288	26	17.4	0.0	6.6	9.7	72.3	34.9
12	259	26	17.5	0.0	6.4	10.5	74.8	42.4
13	299	26	12.0	0.2	6.4	7.2	53.0	33.7
14	303	25	11.9	0.2	6.5	7.4	55.3	21.7
15	306	24	13.0	29.3	5.7	6.7	37.3	18.9
16	306	24	13.1	19.0	6.3	6.4	48.3	31.6
17	303	23	13.3	19.1	7.5	6.7	49.6	-
18	307	24	14.4	19.4	7.2	6.2	45.7	18.6
Alternate Filter testing (7300-2018 v.2)								
1	283	24.5	5.1	31.3	5.6	5.9	54.6	>45.0
2	303	24.0	6.4	31.1	6.6	6.2	56.9	24.2
3	313	23.5	6.4	31.1	9.3	6.1	59.4	35.9
4	307	24.0	8.4	30.8	6.6	5.1	40.9	23.3
5	311	23.5	7.9	19.5	6.3	6.8	63.8	>20.9
6	317	24.5	15.8	0.2	7.7	7.3	71.3	36.3
7	303	24.0	16.8	0.2	8.3	7.8	64.7	27.5
8	316	42.5	16.8	0.2	11.6	9.7	79.0	41.9
9	317	24.5	17.7	0.6	8.3	8.2	75.0	23.9

Additional Testing (7495-2020)								
1	300	24.0	7.6	19.2	7.2	5.0	60.0	19.0
2	296	23.5	7.6	19.3	9.5	5.6	61.1	21.0
3	302	25.5	6.1	19.3	7.8	5.1	60.2	20.0
4	301	24.0	6.0	19.3	11.9	5.1	61.4	22.0
Requirements								
Fresh and Brackish Water	-	-	-	<1 / 10-20	>5	>5	>50	-
Marine Water	-	-	-	28-36	>1	>1	>1	-

Table 2 Average numbers (three replicates) of live organisms in Inlet, Treated and Control discharge waters

Test Cycle	Inlet to BWMS			Discharge						
	Organisms > 50 µm [org./ m ³]	Organism 10 – 50 µm [org./mL]	Organisms <10 µm – Heterotrophic bacteria [CFU/mL]	Organisms > 50 µm [org./ m ³]		Organism 10 – 50 µm [org./mL]		Vibrio cholerae [org./100mL]	Escherichia coli [org./100mL]	Intestinal enterococci [org./100mL]
				Treated	Control	Treated	Control	Treated		
	Microscopy	CMFDA/FDA Microscopy	CFU	Microscopy		CMFDA/FDA Microscopy		Colony Forming Units [CFU/100 mL]		
Primary Filter testing (7210-2017 v.8)										
1 ¹	164,429	1,546	420,000	155	130,367	40	963	-	<10	<10
2 ¹	142,008	1,917	670,000	208	130,367	42	963	-	<10	<10
3	3,095,967	9,850	500,000	0.9	1,708,954	2.7	1,167	<1	<10	<10
4	4,584,142	11,650	700,000	1.3	1,708,954	<0.2	1,167	<1	<10	<10
5	1,750,529	6,883	250,000	0.3	840,246	0.2	2,158	<1	<10	<10
6	3,263,958	7,183	280,000	0.3	840,246	<1	2,158	<1	<10	<10
7	2,939,617	3,878	120,000	0.7	1,644,021	<0.2	1,706	<1	<10	<10
8	3,826,000	3,883	150,000	0.8	1,644,021	<0.2	1,706	<1	<10	<10
9	123,133	10,583	73,000	<0.3	117,338	0.5	9,000	<1	<1	<1
10	132,296	8,833	68,000	<0.3	117,338	0.7	9,000	<1	<1	<1
11	168,863	14,867	190,000	2	107,613	3.2	10,850	<1	<1	<1
12	185,817	14,900	250,000	3	107,613	1.7	10,850	<1	<1	<1
13	117,125	11,292	85,000	0.8	71,446	0.5	10,033	<1	<1	<1
14	120,342	9,817	78,000	0.7	71,446	1.2	10,033	<1	<1	<1

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15	114,175	2,175	91,000	<0.3	78,492	<0.2	2,521	<1	<10	<10
16	291,483	3,713	350,000	<0.3	79,729	<0.2	2,050	<1	<10	<10
17	297,058	3,525	370,000	<0.3	230,392	<0.2	2,050	<1	<10	<10
18	407,138	3,978	380,000	<0.3	230,392	<0.2	2,117	<1	<10	<10
Alternate Filter testing (7300-2018 v.2)										
1	136,442	1,325	38,000	<1	65,458	0.3	517	<1	-	-
2	164,308	3,083	35,000	<1	128,354	<0.3	1,187	<1	<10	<10
3	173,442	2,900	30,000	<1	128,354	<0.3	1,187	<1	<10	<10
4	163,092	1,092	26,000	<1	122,013	<0.3	800	<1	<10	<10
5	253,183	1,533	40,000	<1	219,454	<0.3	681	<1	<10	<10
6	122,375	16,883	23,000	0	99,792	<0.3	6,900	<1	<1	<1
7	255,542	11,083	13,000	7	130,500	0.5	11,017	<1	<1	<1
8	257,642	11,867	13,000	7	130,500	0.8	10,633	<1	<1	<1
9 ²	480,267	14,200	21,000	13.1	314,113	0.3	11,183	<1	12	<1
Additional Testing (7495-2020)										
1	507,442	1,029	140,000	<1	389,029	<1	886	<1	<10	<10
2	618,504	1,046	99,000	<1	389,029	<1	886	<1	<10	<10
3	181,908	1,861	310,000	<1	191,944	<1	1,525	<1	<10	<10
4	162,675	1,856	640,000	<1	191,944	<1	1,525	<1	<10	<10
Requirements										
-	≥100,000	≥1,000	≥10,000	<10	≥100	<10	≥100	<1	<250	<100

- 1) Test cycle 1 and 2 for primary filter testing didn't meet the D-2 discharge standard due to a too low concentration of remaining oxidants in the test water after ballasting treatment. This prompted DNWT to change the TRO dosing algorithm to leave higher residual oxidant concentration to meet IMO D-2 standards.
- 2) Test cycle 9 of alternate filter testing failed to meet the D-2 standard due to a malfunction of the filter.

Summary of shipboard testing for BALPURE® BP-36 at a rated flow rate of 3,000 m³/h:

Table 3 Inlet Test water conditions

Test Cycle	Flow rate [m ³ /h]	Holding Time [hours]	Uptake Ballast Water Temperature [°C]	Uptake Ballast Water Salinity [PSU]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]
Shipboard Testing (7230-2018 v.6)							
1	2,721.3	82	15.4	33.0	1.0	<0.1	4.0
2	2,353.0	30	15.9	5.0	2.4	0.4	33.5
3	2,713.6	58	15.2	33.1	1.6	0.1	25.9
4	2,727.5	42	15.6	17.7	2.0	0.2	27.6
5	2,640.2	49	15.3	26.0	1.4	0.1	16.8
6	2,256.7	48	14.2	28.5	1.1	0.2	14.5
7	2,411.2	120	18.1	26.9	1.5	<0.1	17.6
8	2,562.0	-	-	-	-	-	-
9	2,675.0	192	19.8	29.5	1.6	<0.1	21.4
10	2,639.8	120	13.0	29.3	0.9	<0.1	20.1
11	2,540.7	192	17.5	29.3	1.4	<0.1	17.9
12	2,543.2	336	16.5	29.1	1.1	0.2	8.6

Table 4 Average numbers (three replicates) of live organisms in Inlet, Treated and Control discharge waters

Test Cycle	Inlet to BWMS		Discharge					
	Organisms > 50 µm [org./m ³]	Organism 10 – 50 µm [org./mL]	Organisms > 50 µm [org./m ³]	Organism 10 – 50 µm [org./mL]	Vibrio cholerae [org./100mL]	Escherichia coli [org./100mL]	Intestinal enterococci [org./100mL]	
Analysis method	Microscopy	CMFDA/FDA Microscopy	Microscopy	CMFDA/FDA Microscopy	Colony Forming Units [CFU/100 mL]			
1	41,499	206	<1	<1	<1	<10	<10	
2 ¹	238,852	675	13	6	<1	<10	<10	
3	33,231	303	1.2	1	<1	<10	<10	
4 ¹	256,428	237	16	<1	<1	<10	<10	
5 ¹	27,027	129	16.2	1.7	<1	<10	<10	
6 ¹	36,090	157	25.8	0.3	<1	<10	<10	
7	41,385	105	0.4	<1	<1	<10	<10	
8	58,314	128	No discharge					
9	132,465	113	<1	<1	<1	<10	<10	
10	18,620	95	1.0	<1	<1	<10	<10	
11	202,839	128	<1	<1	<1	<10	<10	
12	150,374	102	<1	<1	<1	<10	<10	
Requirements								
	≥ 100	≥ 100	<10	<10	<1	<250	<100	

- 1) Shipboard tests 2, 4, 5, and 6 failed to meet the IMO D-2 standard due to issues with crew operation of the system.